

1. An apparatus for providing a wavelength shifted and stabilized photonic signal, the apparatus comprising:

a photonic input path configured to carry a photonic input signal comprising at least one channel, each channel having a wavelength definable as a function of time;

5 a photonic output path configured to carry a photonic output signal comprising at least one channel, each channel having a wavelength definable as a function of time;

a modulation synthesizer configured to provide a modulation waveform;

a modulation device configured to modulate the photonic input signal with the modulation waveform to provide the photonic output signal;

10 the modulation waveform configured to shift the wavelength of the channels of the photonic input signal to the wavelength of the channels of the photonic output signal; and

a wavelength error detector configured to detect channel wavelength errors in the photonic output signal and provide to the modulation synthesizer an error signal configured to correct the channel wavelength errors in the photonic output signal.

15 2. The apparatus of claim 1, wherein the modulation synthesizer is further configured to receive a data signal, pre-modulating the modulation waveform in accordance therewith to encode the data signal into the photonic output signal.

20 3. The apparatus of claim 2, wherein the modulation synthesizer is configured to encode the data signal using Frequency Shift Keying.

4. The apparatus of claim 3, wherein the Frequency Shift Keying comprises orthogonal codes.

5. The apparatus of claim 2, wherein the modulation synthesizer is configured to encode the data signal using ON/OFF Keying.

6. The apparatus of claim 2, wherein the modulation synthesizer is configured to encode the data signal by pre-modulating with orthogonal codes.

7. The apparatus of claim 1, further comprising:  
a shift input line configured to carry a shift signal; and  
the modulation waveform further configured to shift the wavelength of the photonic output signal with respect to the wavelength of the photonic input signal, in proportion to the shift signal.

8. The apparatus of claim 7, wherein the shift signal comprises a spreading function.

9. The apparatus of claim 7, wherein the shift signal comprises a gathering function.

10. The apparatus of claim 7, wherein the shift signal comprises the difference of two spreading functions.

11. The apparatus of claim 7, wherein the shift signal comprises a range of allowable wavelength shifts.

12. The apparatus of claim 1, wherein the modulation device comprises a phase modulator.

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13. The apparatus of claim 1, wherein the modulation device comprises a quadrature device.

14. The apparatus of claim 13, wherein the quadrature device comprises an upper branch and a lower branch, each having a transfer function, the modulation waveform being a quadrature waveform comprised of upper and lower waveform components corresponding to the upper and the lower branch, the upper and lower waveform components being substantially 90 degrees out of phase.

15. The apparatus of claim 14, wherein the upper and lower waveform components are substantially sinusoids divided by the transfer function of the upper and lower branches respectively.

16. The apparatus of claim 14, wherein the upper and lower waveform components are substantially sawtooth in shape.

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17. The apparatus of claim 14, wherein the upper and lower waveform components are substantially triangular in shape.

18. The apparatus of claim 1, wherein the modulation waveform is substantially sawtooth in shape.

19. The apparatus of claim 1, wherein the modulation waveform is substantially triangular in shape.

20. The apparatus of claim 1, wherein the wavelength error detector is selectively tunable to an arbitrary wavelength.

21. The apparatus of claim 1, wherein the photonic output signal comprises a representative channel, and the wavelength error detector is configured to detect the channel wavelength errors in the representative channel.

22. The apparatus of claim 1, wherein the wavelength error detector averages the channel wavelength errors of multiple channels.